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## 吸水防霧塗層的制备及其結構表征

Preparations and Structure Characterizations of Coatings  
with Water-absorbing Anti-fogging

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## 摘 要

汽车玻璃的面积约占汽车表面积的 1/3，要求具有较好的光学性能、力学性能，同时还要求具备耐磨性能、耐热性能、安全性、密封性和隔音性能等，以保障乘员的安全。目前，汽车玻璃的发展方向主要有两个：一是提高汽车玻璃的安全性能，二是汽车玻璃的功能化。为了有效地改善车内的舒适性和提高汽车玻璃的功能，可以在保证汽车玻璃安全性的基础上附加调光、隔热、防眩、憎水、抬头显示、天线、光伏电加热等功能。

受环境温度和湿度的影响，汽车玻璃起雾是很常见的问题。起雾主要是因为当水汽接触到汽车玻璃后，由于玻璃表面温度较低，其水分的饱和蒸气压低于周围环境的饱和蒸气压，所以水汽就会在玻璃的表面聚集成水珠而形成雾。雾气使玻璃变得模糊，遮挡驾驶员的视线，易引发各种交通事故，危害人的生命安全。因此，汽车玻璃的防雾也属于一个重要的功能。

本文在总结前人实验的基础上，通过共混法制备了基底树脂层溶胶和防雾涂层溶胶，在玻璃表面制备了具有双层结构的防雾功能性涂层，研究了不同成分比对防雾时间的影响。以聚乙二醇为成孔剂与溶胶混合，采用刮涂法在玻璃基体上制备了具有吸水防雾功能的薄膜。

本研究的主要研究内容及结果如下：

1、采用共混法制备了与玻璃粘结性良好的基底树脂层，通过改变双酚 A 环氧树脂与固化剂的比例，添加适量的硅烷偶联剂及有机硅溶胶，使膜层在具有较强粘结力的同时，还保持较高的硬度和可见光透过率。

2、采用刮涂法在预先涂有基底树脂层的绿玻上，制备具有防雾功能的玻璃片材，利用 SEM、FT-IR、DSC 对薄膜进行表征。结果表明，所制备的吸水防雾玻璃，具有较好的防雾性、耐磨性、粘结性能。选择合适的固化剂在最佳成分的情况下，可得到既具有良好防雾性能，又具有较好耐机械破坏性能的应用型物品。

3、主要研究了不同分子量的聚乙二醇对防雾玻璃的性能影响及作用机理，并利用 FT-IR、SEM 和 DSC 等对其进行了表征，得到以下结论：通过添加聚乙二醇，改变了制备膜层的微观结构，改变了饱和吸水量，延长了防雾时间；添

加聚乙二醇前后的防雾涂层玻璃化转变温度没有变化,聚乙二醇在防雾溶胶体系中并不参与反应,水浸泡后被除去,只起到成孔剂、改变膜层内部三维结构的作用;由样品红外谱图看出防雾涂层具有较高的亲水基团含量,对膜层表面的水分子有较强的吸附作用。

4、在玻璃基材上制备膜层都具有的良好的防雾性、耐磨性、抗刮性、粘结性和硬度,且其打磨后的雾度值可以控制在 2.0% 上下,可见光透射比都在 75% 以上,综合性能好,在汽车玻璃上有应用前景。

**关键词:** 汽车玻璃, 防雾, 吸水树脂, 耐磨

## Abstract

Automotive glass, which accounts for about 1/3 of automobile surface area, needs to meet optical properties, good mechanical properties, in the mean time, wear resistance, heat resistance, safety, sealing and sound insulation performance in order to guarantee the safety of the passengers. At present, automotive glass is mainly developed in two directions: one is to enhance the safety performance of automobile glass; the other is the functionalization of the automobile glass. In order to improve the comfort of the car and increase the functionality of automotive glass, we take into account heat insulation, hydrophobic, dimming, head-up display, and photovoltaic electric heating function on the base of safety.

The fogging on glass surface is a noteworthy problem at the influence of environmental humidity and temperature. On low temperature surface, water vapor condenses on glass surface, and precipitates in the form of tiny droplets of fog formation, which can lead to diffuse reflection of light, when the saturated water vapor pressure is lower than the vapor pressure of the surrounding environment. The fogging on windscreen of the vehicle will block the driver's view, easily cause accidents and directly affect the safety of people. Therefore, antifogging is an important function of automobile glass.

In this paper, the base resin layer sol and antifogging coating sol were prepared by blending method, and an antifogging double-layer functional structure were prepared on glass surface. The effects of different compositions on antifogging time were discussed. In order to further improve the water absorbing and anti-fogging property, PEG was added as a pore forming agent.

The main results are shown as follows:

1. The base resin layer with good adhesion to glass was prepared by blending method, meanwhile, high hardness and visible light transmittance were maintained by changing bisphenol A epoxy resin and curing agent ratio, and adding silane coupling agent and organic silicon sol.

2. The water absorbing and anti-fogging coatings were prepared on green glass with substrate layer coated previously. The films were characterized by SEM, FT-IR, DSC. The results show that antifogging glass has good water absorbing and



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